ENERGY SAVINGS OPPORTUNITY SURVEY
FORT RILEY, KANSAS
CONTRACT No. DACA 41-85-C-0096

EXECUTIVE SUMMARY

KANSAS CITY DISTRICT

CORPS OF ENGINEERS

THE SCHEMMER ASSOCIATES INC.

ARCHITECTS · ENGINEERS · PLANNERS

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INTRODUCTION

This report has been prepared under Contract No. DACA 41-85-C-0096, Energy Saving Opportunity Survey modified to include increment F, Fort Riley, Kansas. The complete report consists of the following:

Executive Summary

Volume I - Executive Summary

Volume II - ECO Analysis

Volume III - ECO Analysis

Volume IV - Funding Documentation

Field Survey Data (Retained from previous submittal)

The official date of this document is:

31 July 1987

DEPARTMENT OF THE ARMY
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EXECUTIVE SUMMARY

A. OVERVIEW

The Schemmer Associates Inc. began to accomplish this Energy Savings Opportunity Survey (ESOS) at Fort Riley in the Fall of 1985. Our project team has consisted of mechanical engineers, electrical engineers, architects and technicians, involved in each different phase of the project. A Preliminary Submittal was made in December 1985 and the Interim Submittal was made in May 1986. This report is the final phase of the project.

We first accomplished extensive field surveys of the buildings to be analyzed. A team of architects and engineers thoroughly investigated and photographed the existing conditions in each building. We appreciate the cooperation we received from Fort Riley personnel during this disruption of their operations. This field survey data is provided in a separate volume, retained from a previous submittal.

The analysis of energy conservation opportunities (ECO's) was the next phase of the project. The ECO's for each building are presented in Volumes 2 and 3 with architectural (envelope-related) items first, then mechanical items and then electrical items, each in order of descending Savings to Investment Ratio (SIR). Those projects which are recommended for implementation (SIR greater than or equal to one) are summarized at the end of this section, in order of descending SIR. Summaries of the projects to be funded by ECIP, QRIP and PECIP are also included.

The funding documentation for these projects is assembled in Volume 4 of this report. The completed Project Development Brochures (PDB), DD1391 Forms and supporting data are ready for review and signature by the Post commander to apply for ECIP funding. Also completed and ready for signature are the required forms for those projects being submitted for QRIP/PECIP funding. The "packaging" of these projects for funding was determined following the Interim Submittal.

We have used a number of computer programs to aid in the calculation of energy savings. For savings from improvements in insulation and reduced infiltration, we used simple degree day methods. For more complicated opportunities, we used "Simplified Energy Analysis" (SEA) by Ferreira and Kalasinsky Associates, Inc. SEA is based on the modified bin method as described in the ASHRAE publication "SIMPLIFIED ENERGY ANALYSIS USING THE MODIFIED BIN METHOD." Cost estimates have generally been prepared using "MEANS" cost data. The escalation rates used were from the Engineering Improvement Recommendation System (EIRS) Bulletin 86-03 (30 June 1986). Wage rates were provided by the Kansas City District.

The analysis of seven additional "options" was included in this ESOS. The data for these are presented in a later section of this volume.

- Option 1 analyzed alternatives for modifications to the street lighting in some of the family housing areas. All alternatives were found to have an SIR less than one and none are recommended at this time.

- Options 2 and 3 provided recommendations for equipment and procedures for testing of steam traps and maintenance of boilers.

- Option 4 investigates solar swimming pool heating and Option 5 solar domestic hot water for family housing. Both were found to have SIR's less than one and are not recommended at this time.

- Option 6 analyzed alternatives for exit lights and exterior lighting at barracks and motor pools. While no alternative in the analysis of the exit lights proved to be feasible, changing the exterior lighting is feasible (SIR greater than one) and should be implemented.

- Option 7 investigated the feasibility of primary-secondary pumping for the two chilled water plants on Custer Hill. This modification proved to be feasible for the plant serving the 7000 series buildings and the plant serving the newer 8000 series buildings. Providing an electric centrifugal chiller to produce chilled water in lieu of the existing steam-fired absorption chillers was also analyzed. This modification to the 8000 series plant also proved to be feasible and is highly recommended for implementation.

Summarizing the energy conservation opportunities, the projects that are recommended for implementation can be grouped as follows:

1. Insulation and Window Improvements - This project includes wall insulation, roof/ceiling insulation and various window improvements such as adding storm windows and blocking off glass with insulated panels in 34 buildings. This project is recommended for ECIP funding, with an overall SIR of 2.5 and discounted energy savings of $1.1 million.

2. Replace Incandescent Lighting Fixtures - This project includes replacement of interior and exterior incandescent lighting fixtures with higher efficiency fixtures such as fluorescent and high intensity discharge (HID-such as high pressure sodium in 54 buildings. The project is recommended for ECIP funding, with an overall SIR of 4.0 (including maintenance savings) and discounted energy and maintenance savings of almost $1 million.

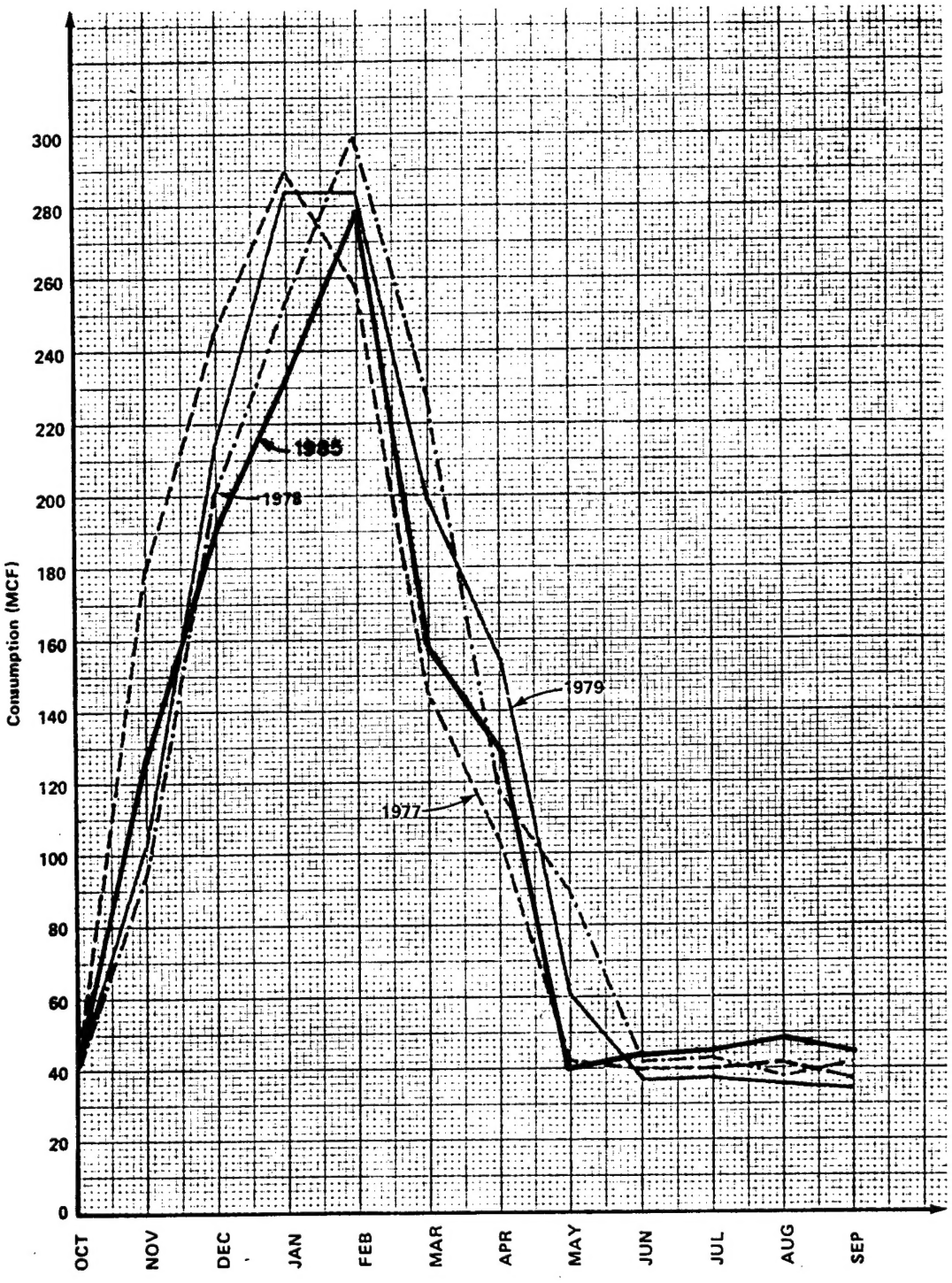
Sheet Title

POST NATURAL GAS CONSUMPTION

Add. No.

Sheet No. 3

FORT RILEY, KANSAS



Job Title	Job No.	Date	Drawn
FIGURE 1			MDN

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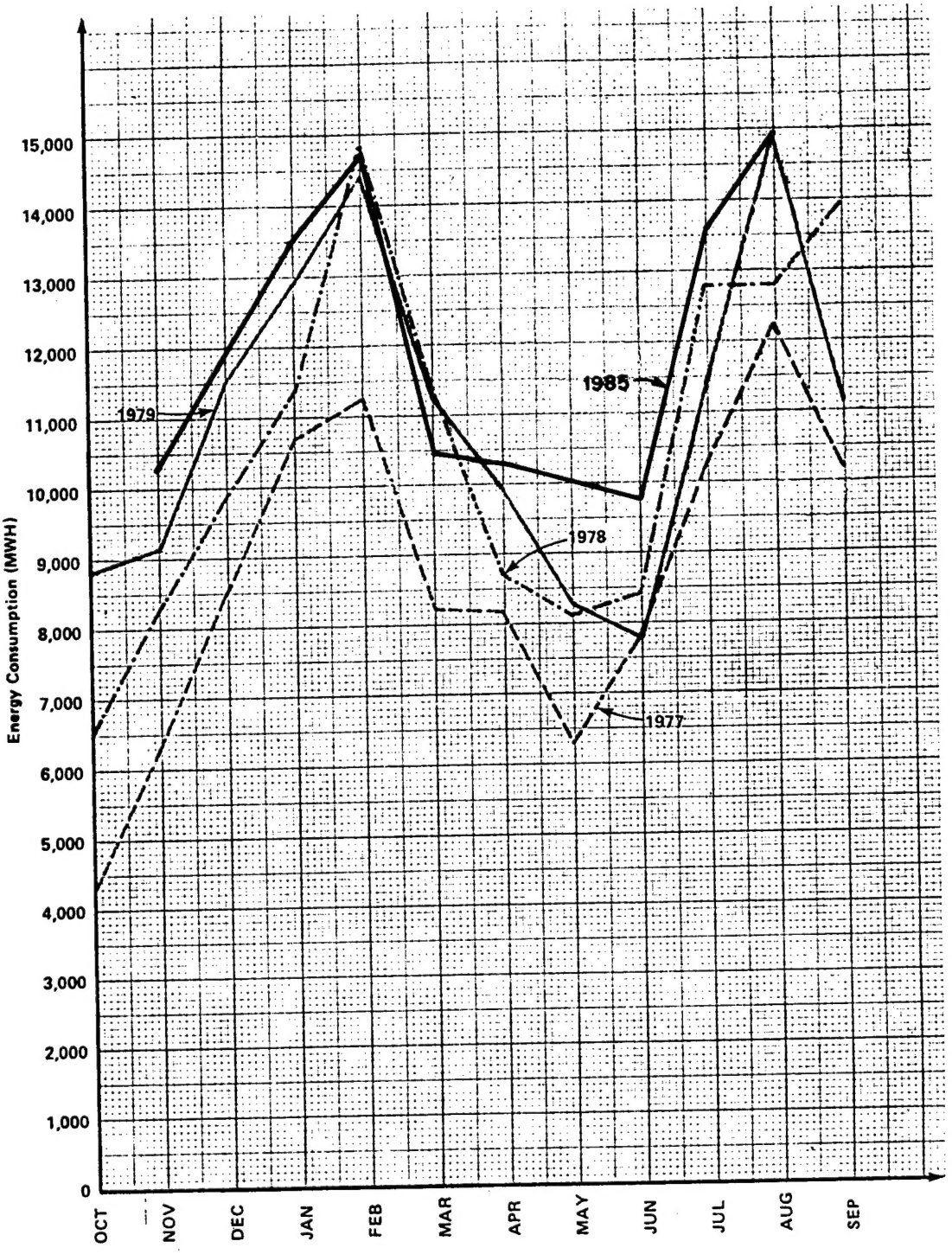
Sheet Title

POST ELECTRICAL CONSUMPTION

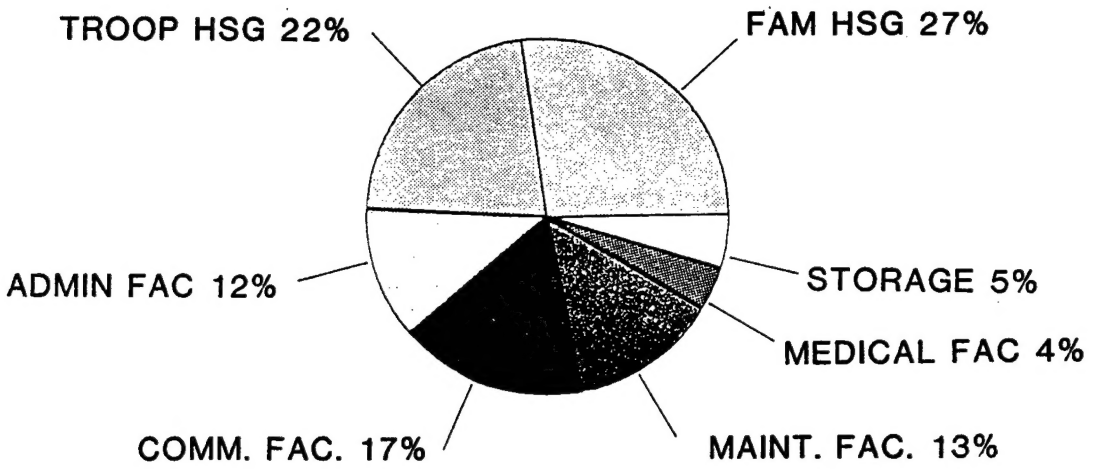
FORT RILEY, KANSAS



Job Title	Job No.	Date	Drawn
FIGURE 2			MDN

THE SCHEMMER ASSOCIATES INC.

APPROXIMATE PERCENT OF TOTAL ENERGY CONSUMPTION BY BUILDING TYPE



REF: ARMY FACILITIES PLAN, P.21

FIGURE 3

3. Miscellaneous Mechanical Improvements - These projects include temperature control repair and function changes in 14 buildings and providing separate domestic water heating for three barracks. These projects are recommended for QRIP/PECIP funding, having SIR's of 6.3 and 4.2, respectively. Total discounted energy savings is approximately $425,000.

4. Other Projects - Some projects identified as feasible energy conservation opportunities, but which do not meet the criteria for the above funding programs, are identified for "local" funding. Adding buildings to the Post Energy Monitoring and Control System (EMCS) and other miscellaneous improvements are included here.

Implementation of these recommended energy conservation opportunities has an overall simple payback of five years, with annual energy savings of close to 53,000 million Btu ($235,000). The ECIP projects, recommended for programming in 1991, have a programmed year cost of $817,000 and the QRIP/PECIP projects have a programmed year cost of $87,000 (programmed year 1989).

The ESOS identified approximately 160 recommended energy conservation opportunities at Fort Riley. The scope of this ESOS included only a small portion of the total building area on the Post, so comparisons of the energy savings due to these ECO's to the total energy consumption of the Post are not very meaningful. However, Figures 1 and 2 are presented to indicate the trends in total Post energy consumption. Figure 3 indicates the largest users of energy in a typical Army Facility. This indicates that energy conservation efforts need to be on-going, otherwise consumption will increase as time passes. And, if consumption increases and as energy costs continue to rise, more and more dollars will be spent on energy that could be better spent on productive Post activities.

As a general observation, maintenance of the Fort Riley facilities has been neglected in the past. A renewed emphasis is being given to maintenance at this time. Implementation of the JC/85-40 energy monitoring and control system (EMCS) should aid this effort by providing the opportunity for scheduled preventative maintenance reports based on run time of equipment. Proper maintenance of the buildings has a profound effect on energy consumption (such as replacing broken windows and boiler maintenance), and energy conservation efforts can have a profound effect on maintenance. In the ECO's that we have suggested, we have avoided maintenance-intensive systems, such as heat recovery loops and active solar energy systems. We recognize the need to save on energy costs without increasing maintenance costs. Other general observations are as follows:

1. ARCHITECTURAL

Main Post Envelope: Existing wall construction consists of 12-18" native stone, a material of low thermal resistance. The roof construction typically consists of wood planks, tarred shingles, an attic and a surface material. The windows are generally double hung, wood framed construction.

Custer Hill Envelope: Existing wall construction consists of a 4" brick exterior, 2" of air space, and 4" or 8" concrete block. The roof construction generally contains built-up roof, 1" of insulation, and concrete or steel deck supporting surfaces. The windows consist both of aluminum awning and double hung configurations. The floor is generally concrete with a crawl space.

General Observations:

- A majority of the Main Post buildings were insulated in the attic spaces to an adequate level.
- The Main Post buildings with no roof insulation always had SIR's over one for adding roof insulation; a reduction in volume of heated space by installation of suspended ceilings was sometimes possible which increased savings. (Analysis of buildings shows a savings of 4839 MBTU/YR or $15,388/YR.)
- None of the buildings had exterior wall insulation; insulating the walls is a feasible ECO in some buildings. (Analysis of buildings shows a savings of 2330 MBTU/YR or $7430/YR.)
- Windows with painted panes, or which were physically obstructed by permanent objects, were considered feasible to block with insulating panels. (Analysis of buildings shows a savings of 771 MBTU/YR or $2450/YR.)
- Buildings on the Main Post have large window areas, but removing windows (partially or whole) disrupts the historic character of the buildings. Blocking windows from the interior proved to be a feasible ECO. (Analysis of buildings shows a savings of 54 MBTU/YR or $172/YR.)
- Reduction of glass was analyzed in all Custer Hill buildings. It had the highest SIR in the dining facilities. (Analysis of buildings shows a savings of 5785 MBTU/YR or $19,782/YR.)
- In the dining facilities on Custer Hill, a majority of attic and crawl space doors were left open. The occupants should be instructed to keep them closed. (Estimated energy savings per square foot of roof or floor area is 424,480 BTU/SF-YR.)

- Infiltration losses can be reduced in almost all the existing vestibules if measures are taken to weatherstrip interior doors as well as exterior. (Estimated energy savings of a typical single 7'x3' door vestibule is 343,830 BTU/YR.)

- Replacing existing windows with new ones does not meet ECIP test SIR criteria, so adding storm windows was analyzed. They proved to be a feasible ECO for many buildings. (Analysis of buildings shows a savings of 2925 MBTU/YR or $9,573/YR.)

- In general, a lack of maintenance such as no weather-stripping, misalignment of windows and doors, broken glass panes, lack of caulking and sealant, cracks and holes increase energy loss and should be repaired as needed.

2. MECHANICAL

Some general mechanical energy conservation opportunities are summarized below. These items apply to a large number of buildings and due to the low cost of implementation, supporting calculations are not provided.

- The combustion in the boilers serving many of the buildings surveyed was producing a yellow flame. This is an indication that there is insufficient air for complete combustion which reduces boiler efficiency. Louvers and screens should be cleaned or added where possible. A 1% decrease in efficiency for a typical 500,000 BTU output boiler wastes 1083 MBTU/YR or $3460/YR.

- During the survey, it was noticed that many of the time clocks which had been installed were not operating. As a minimum, time clocks require maintenance twice a year (when daylight savings time starts and stops). We do not feel that the installation of time clocks is a good idea due to the maintenance required, but we do feel that setback savings cannot be ignored. Where possible, the savings from setback can be used to justify the use of an energy monitoring and control system. Where night setback can be used, energy savings for buildings will range from 5%-15% of yearly heating energy consumption.

- Wherever possible, the gas-fired domestic water heaters should be turned off. In many office-type occupancies, domestic hot water is not required. Water heaters that are not insulated and that are expected to remain in service should be insulated. Turning off a 40-gallon water heater would save 24.6 MBTU/YR or $78/YR.

- In accordance with ASHRAE 90A-1980 recommendations, all piping above 120 degrees and below 55 degrees F should be insulated. Energy savings may range from 24,000 BTU/LF-YR. for 1/2" pipe at 120 degrees F. to 315,996 BTU/LF-YR for 3" pipe at 180 degrees F. ($0.76/LF-YR to $1.01/LF-YR.)

- Domestic water heaters in barracks are currently set at 140 degrees F. The setpoint should be readjusted to 120 degrees F. at the highest, for a substantial energy savings. (Barracks with dining halls attached may require replacement of the rinse water booster heater to provide 180 degrees F. water.) Estimated savings for reduction of the water temperature in a 500-gallon storage tank are 3.9 MBTU/YR or $13/YR.

3. ELECTRICAL

Energy Efficient Motors. When a motor becomes defective and needs to be replaced, replacement should be made with an energy efficient type. The cost of this ECO would be considered as the additional cost of the efficient motor over a standard one. Only the additional cost is considered, as the motor would need to be replaced regardless of type of motor. The annual savings with different sizes of motors operating 12 hours per day are as follows:

1 HP Motor	-	4.8	MBTU - $20
1-1/2 HP Motor	-	6.8	MBTU - $29
2 HP Motor	-	6.5	MBTU - $28
3 HP Motor	-	11.9	MBTU - $51
5 HP Motor	-	17.0	MBTU - $72

Energy Savings Ballasts. When ballasts become defective in fluorescent and HID fixtures, replacement should be made with energy efficient type. The cost of this ECO would be the additional cost of the efficient ballast over a standard one. Energy saving fluorescent ballasts are available from nearly all manufacturers. Energy savings ballasts in a 4 lamp fixture operating in a typical office would save .76 MBTU or $3.20 per year per fixture. HID ballast ratings vary from one manufacturer to the other. A ballast could be chosen that has a lower loss and thus more energy savings.

Energy Saving Lamps. At fixture lamp burnout for fluorescent fixtures, replacement should be made only with energy-saving lamps. The cost of this ECO is considered as the additional cost of the energy-saving lamps over standard lamps. During the survey, it was observed that most rooms contained a mixture of standard and energy-saving type lamps. It appears the Post is following a course of replacing lamps with efficient types, and should continue to do so. An energy saving lamp replacement in a typical office environment would save .19 MBTU or $.81 per lamp per year. Sylvania manufactures a high-pressure sodium lamp that directly replaces mercury vapor lamps without a ballast changeout. This is another low-cost, energy-saving lamp change that could be implemented. In the buildings surveyed on the Post, the only ones with mercury vapor were the gymnasiums, of which most were scheduled for fixture replacement. The mercury vapor lamp changeout could be valid if the condition exists in buildings not surveyed. Replacing a 250 watt Mercury Vapor lamp, that operates 10 hours per day, with the HPS lamp would save 1.5 MBTU or $6.30 per year per lamp.

Lamp Changeout to Different Style. Another low-cost energy-saving alternative is to replace incandescent lamps with the miniature fluorescent PL type lamps. Ballasts are available that screw right into the existing socket. The lamps produce approximately the same lumen output with up to 75 percent less

energy usage. This type of changeout is recommended for closets, storage rooms and other rooms where lights may be used very little and the cost of a complete fixture changeout cannot be justified. Also, buildings on the Main Post have many spaces such as corridors and stairwells where this change would be a good alternative. The PL lamps cost significantly more than incandescent lamps, but they last over ten times longer than incandescent. The 9 watt fluorescent PL type lamp, which replaces a 60 watt incandescent, operating 1500 hours per year, would save .84 MBTU or $3.50 per lamp per year. The initial expense is the greatest but the ballast is reusable so only lamp changeout is later required. This change is not recommended for boiler rooms as the PL lamp lumens are not as high as 300 watt incandescent. One option to consider for boiler rooms is a similar screw-in type HID fixture. (The existing fixture must be capable of supporting 15 pounds of ballast weight.) This type changeout is not inexpensive and a complete fixture change to a two-lamp fluorescent fixture is much more economical for boiler rooms. This would save 4 MBTU or $16.80 per fixture per year.

New Less-Wattage Fixtures. When any fixture becomes defective and replacement is needed, consideration should be given to a more energy-efficient type. Fluorescent for incandescent and HID for fluorescent are prime examples. The low cost is based on the fixture replacement requirement. This replacement may be suited to storage and similar areas as a mixing of lamp sources may not be desirable in offices and other occupied areas.

Fixture Cleaning. Perhaps, the simplest low-cost alternative is to clean the fixtures in place. Either cleaning thoroughly or a quick dusting at lamp changeout would both be effective. The possibility exists of removing some fixtures if a cleaning would raise the light levels. In any new design, a lesser amount of fixtures could be utilized if a periodic cleaning could be counted on.

Calculations. Backup data for the above ECO's is presented in Section III of Volume I.

B. SUMMARY OF PREVIOUS STUDIES

Two previous energy conservation projects have been done by Burns and McDonnell for Fort Riley. We have included the summaries from their reports here. It appears that many of the recommendations have been implemented; however, the previous studies covered many areas of the base that we have not. The projects suggested and those considered but not recommended generally agree with our experience. The analyses performed are professional and appear reasonably accurate.

1982 Study Overview

On September 2, 1980 the Integrated Energy Master Plan for Fort Riley, Kansas was delivered to the U.S. Army Engineer District in Omaha, Nebraska. This master plan investigated and determined the best opportunities for Energy Conservation Investment Program (ECIP) projects at Fort Riley. Included within this plan were an installation energy profile, an analysis of the central plants and utility distribution systems, potential ECIP projects, an energy monitoring and control system, possible solar energy utilization and utility metering. The master plan recommended 24 ECIP projects.

In many instances the master plan looked at the Fort on a macro scale, grouping similar buildings together where possible and developing ECIP projects based on computer simulations for each group. Following completion of the master plan, it was determined that a detailed analysis of several Fort buildings was in order; thus, authorization was issued for Increment G of the Integrated Energy Master Plan.

Purpose of Increment G

The purpose of this report was to review and analyze those feasible energy saving projects developed in previous efforts which did not qualify under the ECIP criteria or which were excluded from the previous scope. The analysis consisted of determining energy savings, E/C ratio, B/C ratio, and the estimated project costs necessary to accomplish each project.

Recommendations

A total of eight ECIP projects were recommended for implementation at Fort Riley. These projects are listed, with pertinent information in Table II-2.

General Notes and Comments on 1982 Study

1. The cost of natural gas had increased from $2.51 in 1980 to $2.92/MBTU in 1982.

2. The cost of electricity had increased from $3.17 in 1980 to $3.78/MBTU in 1982.

ECIP PROJECT SUMMARY

Project	Econ. Life (Years)	Nat. Gas Saved MBtu/yr	Elect. Saved MBtu/yr*	Annual Energy Saved $	Initial Capital Cost $	Benefit/ Cost Ratio	E/C Ratio	Payback Period Years
Hospital Rebalance	15	22,150	18,900	138,915	218,000	8.1	200	1.5
1001 Family Housing Night Setback	15	None	8,774	33,166	67,159	6.1	131	2.0
O'Donnell Heights Night Setback & Replace Furnaces	15	9,612	None	28,067	110,000	3.9	87	3.9
Shops 129 & 157 Insulate Garage Doors	25	38	None	111	528	4.2	72	4.8
Medical Clinic 1208 Insulate Walls, Ceiling & Floor, Night Setback, Replace Furnace	15	204	37	736	3,496	2.7	69	4.8
Hospital Pipe Insulation & Ductwork	25	353	27	1,133	9,517	2.4	39	8.4
Field House 32 Radiant Heat for Gym	25	966	113	3,248	33,615	1.9	34	9.8
Theater 163 Alternative A Variable Volume Air System for Auditorium	15	425	126	1,717	19,780	1.1	30	10.9
Theater 163 Alternative B Variable Volume Air System & Night Setback Controls for Auditorium	15	995	163	3,521	43,259	1.1	28	11.6
TOTALS**		34,318	28,014	208,897	485,574			

* 11,600 Btu/kWh

** Theater 163 Alternative A not included in totals

3. This study seemed to drift from what we understood the purpose of our study to be. It included many areas of the Fort which we are not familiar with.

Scope of 1980 Study

The scope of the 1980 study was to perform a complete energy analysis of Fort Riley. This was accomplished in the following manner:

Field verification of existing conditions in all buildings located on the building area of the Fort.

Preparation of a computer model for a representative group of buildings.

Evaluation of all energy savings opportunities that would reduce total Fort energy consumption and develop Energy Conservation Investment Program (ECIP) projects.

Evaluation of solar energy applications.

Evaluation of Energy Monitoring and Control Systems (EMCS) study that had been recently completed.

Evaluation of use of solid waste fuel.

Evaluation of central plant and utility distribution systems. (Steam, chilled water, electricity, gas, and potable water.)

Conclusions

Table II-1 indicates the list of possible Energy Conservation Investment Program projects suggested in the 1980 study.

General Notes and Comments on 1980 Study

1. Most calculations were based on a 25-year life.

2. The cost of natural gas has increased from $2.51 in 1980 to $3.18/MBTU in 1986.

3. The cost of electricity has increased from $3.17 in 1980 to $4.23/MBTU in 1986.

4. It appears that the majority of the items in the report are being, or have been, implemented.

Table II-1
TOTAL ENERGY SAVINGS**

	ECIP I.D.	Project	Econ. Life	Energy Saved (MBtu)			Annual Engr Saved ($)	Initial Capital Cost ($)	Ben/ Cost Ratio	E/C Ratio	Payback Period
				Fuel Oil	Nat. Gas	Elec.					
1.	I	Repl Air Fltr	1	—	—	44,164	$140,000	$20,089	6.9	2,323	0.2
2.	G	Seal Vnt Shft	25	—	12,722	—	32,058	11,205	57.4	1,204.5	0.3
3.	S	Chil Optim	15	—	2,570	20,816	72,438	61,046	14.7	404.8	0.8
4.	C	Night Stbck	15	—	46,840	—	117,570	136,330	11.3	363.0	1.1
5.	K	150wl to 250 HPS	25	—	—	1,333	9,345	15,033	8.4	81.4	1.5
6.	K	300wl to 400 HPS	25	—	—	904	4,506	7,142	9.5	121.0	1.5
7.	P	VAV Hosp.	25	—	53,705	42,573	269,746	683,565	7.5	148.8	2.4
8.	K	Incan to Fluor	25	—	—	2,594	13,798	37,820	5.4	68.0	2.5
9.	K	Ballast to Discnt	25	—	—	2,202	7,240	19,305	3.3	121.0	2.5
10.	Q	Ch Ppng: B.7210	25	—	—	382	1,210	3,557	6.8	118.0	2.7
11.	D	Stm Rad Cntl	15	—	79,391	—	176,681	638,660	3.6	116.5	3.4
12.	R	Ch W Pmp: B.7210	25	—	—	1,681	5,129	19,080	5.5	93.3	3.5
13.	VIII	Sld Wst Util	20	78,055	—	,292	360,225	1,711,753	4.4	42.6	4.6
14.	M	Flue Dampers	15	—	12,732	—	31,957	195,154	2.1	68.9	5.8
15.	F	Insulate Roof	25	—	13,021	—	33,157	217,966	3.0	64.0	6.2
16.	J	Flow Limiters	25	—	47,458	1,450	123,716	883,455	2.8	58.5	6.8
17.	K	Mer. Vap. to HPS	25	—	—	434	1,709	12,487	2.3	32.0	6.8
18.	A	Boil. Repl.	25	—	71,020	—	178,260	1,402,030	2.5	53.5	7.4
19.	B	Comb. Air	25	—	7,110	—	17,850	191,050	1.8	39.3	10.1
20.	L	Ind. Elec. Mtrg.	25	—	—	54,687	98,061	1,190,020	2.0	48.4	11.5
21.	O	Ht. Recov: B.486	25	—	—	191	479	5,581	1.5	37.6	14.4
22.	K	Incan. St. to HPS	25	—	—	1,978	10,280	157,518	1.0	13.0	14.5
23.	H	Circ. Htd. Air	25	—	2,110	—	5,271	85,947	0.8	25.3	15.4
24.	N	Heat Pumps	25	—	—	28,780	91,230	1,702,156	1.0	17.9	17.7
25.	IX	Sol Ht Pol (NEW)	25	1,496	—	—	11,087	241,130	0.9	6.5	20.5
26.	E	Insul. Walls	25	—	38,060	—	95,530	3,316,749	0.6	12.1	32.9
27.	IX	Sol ht Pol (CON)	25	1,496	—	—	11,087	543,180	0.4	2.9	46.1
28.	IX	Sol Pht BLR MU	25	—	136	—	340	34,450	0.2	4.2	95.6
29.	IX	Sol Ht WT (Dom)	25	—	100	—	252	49,400	0.1	1.8	204
		Total		81,047*	379,015*	196,877*	$1,920,212*	$13,592,858			

Totals will decrease if all projects are implemented due to overlap of projects on many buildings.

**FY 83 Costs.*

C. GENERAL ENERGY CONSERVATION OPPORTUNITIES

Annex A to the Scope of Work identified forty-two (42) energy conservation opportunities for consideration in each building. Those which were not analyzed are identified here, along with the reason for their rejection.

1. Vestibules - investigated, but not feasible due to high construction costs.

2. Load dock seals - buildings investigated do not have loading docks.

3. Improve power factor - Ft. Riley is not penalized for power factor, and currently does not produce their own power.

4. Economizer cycles (dry bulb) - air handing systems in buildings investigated were generally provided with economizer cycle controls.

5. FM radio controls - these controls generally are used in post housing areas, which were not investigated.

6. Radiator controls - these controls are existing.

7. Heat reclaim from hot refrigerant gas - this ECO is not feasible due to high construction cost and low utility rates.

8. Install time clocks - night setback is best accomplished with EMCS, and was analyzed with EMCS.

9. Revise boiler controls - boiler testing procedures are provided to allow Post maintenance personnel to identify boiler controls which need replacement.

10. Return condensate - condensate is returned in all buildings with steam heating systems which were investigated.

11. Domestic water heat pumps - this ECO is not feasible due to high construction costs and low utility rates.

12. Transformer over voltage and loading. The voltage was measured at all buildings surveyed and found to be within acceptable limits.

13. Waste heat recovery - large amounts of exhaust and outdoor air makeup were not encountered in the buildings investigated.

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ENERGY SAVINGS OPPORTUNITY SURVEY
FORT RILEY, KANSAS
DACA 41-85-0096

PROJECT SUMMARY: RECOMMENDED ENERGY CONSERVATION OPPORTUNITIES
ANALYSIS DATE: JANUARY 1986
PROGRAMMED YEAR: ECIP - 1991 PECIP/QRIP - 1989
LOCAL - TO BE DETERMINED

BLDG. NO.	PROJECT DESCRIPTION	CONST. COST	SIOH	PROG YEAR COST	ANN'L ENERGY SAVINGS-MBTU GAS	ELEC	TOTAL ANNUAL SAVINGS	SMPL PYBK	SIR	FUND-ING
8069	HUMIDITY CONTRL	$2,996	$165	$3,332	2067 (OIL)		$12,216	0.2	49.9	QRIP
32	INSUL. DUCTS	$540	$30	-	222	-	$706	0.8	17.0	LOCAL
7865	BLOCK O.A.	$340	$19	$378	129	-	$410	0.8	15.9	QRIP
7024	REVISE CONTROLS	$2,546	$140	$2,831	918	-	$2,919	0.9	15.1	QRIP
462	BLOCK GLASS	$1,456	$80	$1,709	219	-	$696	2.1	9.6	ECIP
463	BLOCK GLASS	$1,456	$80	$1,709	219	-	$696	2.1	9.6	ECIP
483	BLOCK GLASS	$1,456	$80	$1,709	219	-	$696	2.1	9.6	ECIP
187	WATER HEATER	$40	$2	-	8	-	$25	1.6	8.1	LOCAL
64	INSULATION	$5,428	$299	$6,372	673	-	$2,140	2.5	8.0	ECIP
7245	LIGHTING	$6,003	$330	$7,048	-	228	$3,943	1.5	6.7	ECIP
7654	LIGHTING	$6,601	$363	$7,750	-	248	$3,707	1.8	6.5	ECIP
7656	LIGHTING	$6,601	$363	$7,750	-	248	$3,707	1.8	6.5	ECIP
32	RED.GLASS	$576	$32	$676	54	-	$172	3.3	6.0	ECIP
7424	LIGHTING	$4,860	$267	$5,706	-	183	$2,512	1.9	6.0	ECIP
7404	LIGHTING	$4,860	$267	$5,706	-	183	$2,512	1.9	6.0	ECIP
7846	LIGHTING	$1,945	$107	$2,283	-	74	$989	2.0	5.9	ECIP
7812	LIGHTING	$1,945	$107	$2,283	-	74	$989	2.0	5.9	ECIP
7848	LIGHTING	$1,945	$107	$2,283	-	74	$989	2.0	5.9	ECIP
7844	LIGHTING	$1,945	$107	$2,283	-	74	$989	2.0	5.9	ECIP
7850	LIGHTING	$1,945	$107	$2,283	-	74	$989	2.0	5.9	ECIP
7810	LIGHTING	$1,945	$107	$2,283	-	74	$989	2.0	5.9	ECIP
7816	LIGHTING	$1,945	$107	$2,283	-	74	$989	2.0	5.9	ECIP
7818	LIGHTING	$1,945	$107	$2,283	-	74	$989	2.0	5.9	ECIP
7842	LIGHTING	$1,945	$107	$2,283	-	74	$989	2.0	5.9	ECIP
7814	LIGHTING	$1,945	$107	$2,283	-	74	$989	2.0	5.9	ECIP
82	INSULATION	$13,464	$741	$15,807	1126	-	$3,581	3.8	5.4	ECIP
7652	CONTROL ADJ.	$140	$8	$156	20	-	$83	1.7	5.4	QRIP
7658	CONTROL ADJ.	$140	$8	$156	20	-	$83	1.7	5.4	QRIP
7602	CONTROL ADJ.	$140	$8	$156	20	-	$83	1.7	5.4	QRIP
7608	CONTROL ADJ.	$140	$8	$156	20	-	$83	1.7	5.4	QRIP
7264	CONTROL O. A.	$7,270	$400	$8,084	907	-	$2,884	2.5	5.2	QRIP
7044	LIGHTING	$3,807	$209	$4,469	-	85	$1,617	2.4	4.9	ECIP
60	INSULATION	$2,306	$127	$2,707	174	-	$553	4.2	4.8	ECIP
83	INSULATION	$7,175	$395	$8,423	540	-	$1,717	4.2	4.8	ECIP
7602	LIGHTING	$9,855	$542	$11,570	-	336	$3,931	2.5	4.6	ECIP
7652	LIGHTING	$9,855	$542	$11,570	-	336	$3,931	2.5	4.6	ECIP
7658	LIGHTING	$9,855	$542	$11,570	-	336	$3,931	2.5	4.6	ECIP
7608	LIGHTING	$9,855	$542	$11,570	-	336	$3,931	2.5	4.6	ECIP
7648	LIGHTING	$3,025	$166	$3,551	-	80	$1,218	2.5	4.6	ECIP
7646	LIGHTING	$3,025	$166	$3,551	-	80	$1,218	2.5	4.6	ECIP
7644	LIGHTING	$3,025	$166	$3,551	-	80	$1,218	2.5	4.6	ECIP
7642	LIGHTING	$3,025	$166	$3,551	-	80	$1,218	2.5	4.6	ECIP
7650	LIGHTING	$3,025	$166	$3,551	-	80	$1,218	2.5	4.6	ECIP
7245	EMCS ECON.	$3,510	$193	-	-	421	$1,781	2.0	4.6	LOCAL
32	LIGHTING	$3,971	$218	$4,662	-	167	$1,900	2.1	4.4	ECIP
863	BLK OUTSIDE AIR	$1,063	$58	$1,182	110	-	$351	3.0	4.3	QRIP

THE SCHEMMER ASSOCIATES INC.
ARCHITECTS · ENGINEERS · PLANNERS

ENERGY SAVINGS OPPORTUNITY SURVEY
FORT RILEY, KANSAS
DACA 41-85-0096

PROJECT SUMMARY: RECOMMENDED ENERGY CONSERVATION OPPORTUNITIES
ANALYSIS DATE: JANUARY 1986
PROGRAMMED YEAR: ECIP - 1991 PECIP/QRIP - 1989
LOCAL - TO BE DETERMINED

BLDG. NO.	PROJECT DESCRIPTION	CONST. COST	SIOH	PROG YEAR COST	ANN'L ENERGY SAVINGS-MBTU GAS	ELEC	TOTAL ANNUAL SAVINGS	SMPL PYBK	SIR	FUND-ING
315	LIGHTING	$3,896	$214	$4,574	-	107	$1,444	2.7	4.3	ECIP
441	WATER HEATING	$29,660	$1,631	$32,982	2996	-	$9,527	3.1	4.2	PECIP
7606	LIGHTING	$4,264	$235	$5,006	-	106	$1,529	2.8	4.1	ECIP
32	WALL INSULATION	$10,438	$574	$12,254	653	-	$2,077	5.0	4.0	ECIP
7245	EMCS START STOP	$15,400	$847	-	1449	-	$4,608	3.3	3.9	LOCAL
5315	LIGHTING	$13,054	$718	$15,325	-	318	$4,233	3.1	3.7	ECIP
6940	LIGHTING	$3,345	$184	$3,927	-	122	$1,088	3.1	3.7	ECIP
7010	LIGHTING	$2,126	$117	$2,496	-	82	$685	3.1	3.7	ECIP
7050	LIGHTING	$2,126	$117	$2,496	-	82	$685	3.1	3.7	ECIP
7053	LIGHTING	$2,126	$117	$2,496	-	82	$685	3.1	3.7	ECIP
7007	LIGHTING	$2,126	$117	$2,496	-	82	$685	3.1	3.7	ECIP
7004	LIGHTING	$2,126	$117	$2,496	-	82	$685	3.1	3.7	ECIP
7013	LIGHTING	$2,126	$117	$2,496	-	82	$685	3.1	3.7	ECIP
60	STORM WINDOWS	$1,631	$90	$1,915	89	-	$283	5.8	3.5	ECIP
7806	LIGHTING	$971	$53	$1,140	-	25	$287	3.4	3.4	ECIP
7804	LIGHTING	$971	$53	$1,140	-	25	$287	3.4	3.4	ECIP
7856	LIGHTING	$971	$53	$1,140	-	25	$287	3.4	3.4	ECIP
7854	LIGHTING	$971	$53	$1,140	-	25	$287	3.4	3.4	ECIP
27	INSULATION	$12,717	$699	$14,930	656	-	$2,086	6.1	3.3	ECIP
187	MISSING STORMS	$1,467	$81	-	69	9	$257	5.7	3.3	LOCAL
7610	LIGHTING	$5,650	$311	$6,633	-	68	$1,574	3.6	3.3	ECIP
7618	LIGHTING	$5,650	$311	$6,633	-	68	$1,574	3.6	3.3	ECIP
7614	LIGHTING	$5,650	$311	$6,633	-	68	$1,574	3.6	3.3	ECIP
7616	LIGHTING	$5,650	$311	$6,633	-	68	$1,574	3.6	3.3	ECIP
7612	LIGHTING	$5,650	$311	$6,633	-	68	$1,574	3.6	3.3	ECIP
187	STORM WINDOWS	$890	$49	$1,045	44	-	$140	6.4	3.2	ECIP
441	LIGHTING	$5,250	$289	-	-	66	$1,438	3.7	3.2	LOCAL
6620	LIGHTING	$7,727	$425	$9,071	-	180	$2,095	3.7	3.1	ECIP
483	LIGHTING	$2,360	$130	$2,771	-	84	$641	3.7	3.1	ECIP
27	RED. GLASS	$2,240	$123	$2,630	107	-	$340	6.6	3.1	ECIP
7808	BLOCK GLASS	$1,002	$55	$1,176	49	-	$156	6.4	3.1	ECIP
7802	BLOCK GLASS	$1,002	$55	$1,176	49	-	$156	6.4	3.1	ECIP
7852	BLOCK GLASS	$1,002	$55	$1,176	49	-	$156	6.4	3.1	ECIP
7858	BLOCK GLASS	$1,002	$55	$1,176	49	-	$156	6.4	3.1	ECIP
7608	BLOCK GLASS	$1,637	$90	$1,922	77	-	$245	6.7	3.0	ECIP
7602	BLOCK GLASS	$1,637	$90	$1,922	77	-	$245	6.7	3.0	ECIP
7652	BLOCK GLASS	$1,637	$90	$1,922	77	-	$245	6.7	3.0	ECIP
7658	BLOCK GLASS	$1,637	$90	$1,922	77	-	$245	6.7	3.0	ECIP
7856	EMCS SETBACK	$20,400	$1,122	-	1449	-	$4,608	4.4	3.0	LOCAL
7854	EMCS SETBACK	$20,400	$1,122	-	1449	-	$4,608	4.4	3.0	LOCAL
7806	EMCS SETBACK	$20,400	$1,122	-	1449	-	$4,608	4.4	3.0	LOCAL
7804	EMCS SETBACK	$20,400	$1,122	-	1449	-	$4,608	4.4	3.0	LOCAL
82	STORM WINDOWS	$335	$18	$393	15	-	$48	7.0	2.9	ECIP
8069	LIGHTING	$2,110	$116	$2,477	-	31	$522	4.0	2.9	ECIP
7245	STORM WINDOWS	$422	$23	$495	16	3	$64	6.6	2.8	ECIP
7856	REDUCE GLASS	$17,723	$975	$20,807	632	186	$2,797	6.3	2.8	ECIP

THE SCHEMMER ASSOCIATES INC.
ARCHITECTS · ENGINEERS · PLANNERS

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FORT RILEY, KANSAS
DACA 41-85-0096

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ANALYSIS DATE: JANUARY 1986
PROGRAMMED YEAR: ECIP - 1991 PECIP/QRIP - 1989
LOCAL - TO BE DETERMINED

BLDG. NO.	PROJECT DESCRIPTION	CONST. COST	SIOH	PROG YEAR COST	ANN'L ENERGY SAVINGS-MBTU GAS	ELEC	TOTAL ANNUAL SAVINGS	SMPL PYBK	SIR	FUND-ING
7606	REDUCE GLASS	$17,723	$975	$20,807	632	186	$2,797	6.3	2.8	ECIP
7656	REDUCE GLASS	$17,723	$975	$20,807	632	186	$2,797	6.3	2.8	ECIP
7806	REDUCE GLASS	$17,723	$975	$20,807	632	186	$2,797	6.3	2.8	ECIP
7245	REDUCE GLASS	$17,723	$975	$20,807	632	186	$2,797	6.3	2.8	ECIP
7804	REDUCE GLASS	$17,723	$975	$20,807	632	186	$2,797	6.3	2.8	ECIP
7854	REDUCE GLASS	$17,723	$975	$20,807	632	186	$2,797	6.3	2.8	ECIP
27	LIGHTING	$2,316	$127	$2,719	-	48	$555	4.2	2.8	ECIP
462	EMCS (3 BLDGS)	$23,572	$1,296	-	1500	-	$4,770	4.9	2.7	LOCAL
83	STORM WINDOWS	$2,924	$161	$3,433	118	-	$375	7.8	2.6	ECIP
7264	LIGHTING	$8,583	$472	$10,076	-	202	$1,944	4.4	2.6	ECIP
7802	LIGHTING	$2,877	$158	$3,378	-	93	$618	4.7	2.5	ECIP
7858	LIGHTING	$2,877	$158	$3,378	-	93	$618	4.7	2.5	ECIP
7852	LIGHTING	$2,877	$158	$3,378	-	93	$618	4.7	2.5	ECIP
7808	LIGHTING	$2,877	$158	$3,378	-	93	$618	4.7	2.5	ECIP
64	LIGHTING	$5,390	$296	$6,328	-	129	$1,143	4.7	2.4	ECIP
7086	BLK OUTSIDE AIR	$367	$20	$408	21	-	$67	5.5	2.4	QRIP
7245	ADD METAL DOORS	$773	$43	-	28	-	$89	8.7	2.3	LOCAL
27	STORM WINDOWS	$4,360	$240	$5,119	158	-	$502	8.7	2.3	ECIP
315	STORM WINDOWS	$6,243	$343	$7,329	186	45	$782	8.0	2.3	ECIP
7230	LIGHTING	$3,735	$205	$4,385	-	51	$759	4.9	2.3	ECIP
7224	LIGHTING	$3,735	$205	$4,385	-	51	$759	4.9	2.3	ECIP
7233	LIGHTING	$3,735	$205	$4,385	-	51	$759	4.9	2.3	ECIP
7227	LIGHTING	$3,735	$205	$4,385	-	51	$759	4.9	2.3	ECIP
462	INSULATION	$5,732	$315	$6,729	192	-	$611	9.4	2.2	ECIP
187	REPLACE BOILER	$25,250	$1,389	-	867	-	$2,757	9.2	2.2	LOCAL
82	LIGHTING	$1,513	$83	$1,776	36	36	$286	5.3	2.2	ECIP
32	INSULATION	$34,463	$1,895	$40,460	3533	-	$3,533	9.8	2.1	ECIP
32	NIGHT SETBACK	$6,280	$345	$6,983	312	-	$992	6.3	2.1	QRIP
801	INSULATION	$11,934	$656	$14,011	367	-	$1,166	10.2	2.0	ECIP
187	INSUL. DOOR	$27	$1	-	1	-	$3	9.0	2.0	LOCAL
92	NIGHT SETBACK	$6,283	$346	$6,987	300	-	$954	6.6	2.0	QRIP
27	REPL. DOORS	$230	$13	-	7	-	$22	10.5	1.9	LOCAL
7264	ADD SOLAR FILM	$1,255	$69	-	31	7	$128	9.8	1.9	LOCAL
7044	REVISE CONTROLS	$15,990	$879	$17,781	730	-	$2,321	6.9	1.9	QRIP
7832	EMCS	$14,670	$807	-	670	-	$2,131	6.9	1.9	LOCAL
7632	EMCS	$14,670	$807	-	670	-	$2,131	6.9	1.9	LOCAL
7024	EMCS	$14,670	$807	-	670	-	$2,131	6.9	1.9	LOCAL
7424	STORM WINDOWS	$33,982	$1,869	$39,895	903	83	$3,223	10.5	1.8	ECIP
7404	STORM WINDOWS	$33,982	$1,869	$39,895	903	83	$3,223	10.5	1.8	ECIP
7285	INSUL & CEILING	$1,856	$102	-	71	7	$166	11.2	1.7	LOCAL
7086	LIGHTING	$3,140	$173	$3,686	-	44	$463	6.8	1.7	ECIP
7865	LIGHTING	$1,830	$101	$2,148	-	27	$275	6.7	1.7	ECIP
7940	STORM WINDOWS	$3,543	$195	$4,159	88	-	$280	12.7	1.6	ECIP
7832	LIGHTING	$10,717	$589	$12,582	-	213	$1,468	7.3	1.6	ECIP
7632	LIGHTING	$10,717	$589	$12,582	-	213	$1,468	7.3	1.6	ECIP
7485	LIGHTING	$800	$44	$939	-	11	$111	7.2	1.6	ECIP

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ENERGY SAVINGS OPPORTUNITY SURVEY
FORT RILEY, KANSAS
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PROJECT SUMMARY: RECOMMENDED ENERGY CONSERVATION OPPORTUNITIES
ANALYSIS DATE: JANUARY 1986
PROGRAMMED YEAR: ECIP - 1991 PECIP/QRIP - 1989
LOCAL - TO BE DETERMINED

BLDG. NO.	PROJECT DESCRIPTION	CONST. COST	SIOH	PROG YEAR COST	ANN'L ENERGY SAVINGS-MBTU GAS	ELEC	TOTAL ANNUAL SAVINGS	SMPL PYBK	SIR	FUND-ING
463	LIGHTING	$773	$43	$908	-	12	$104	7.4	1.5	ECIP
7024	LIGHTING	$12,665	$697	$14,869	-	254	$1,666	7.6	1.5	ECIP
82	WALL INSULATION	$27,628	$1,520	$32,435	596	-	$1,895	14.6	1.4	ECIP
82	BLOCK GLASS	$314	$17	$369	7	-	$22	14.3	1.4	ECIP
7865	INSULATION	$3,031	$167	$3,558	60	6	$216	14.0	1.4	ECIP
5315	STORM WINDOWS	$5,718	$314	$6,713	106	27	$451	12.7	1.4	ECIP
7013	BOILER TIE-7010	$30,580	$1,682	-	601	-	$1,911	16.0	1.3	LOCAL
7050	BOILER TIE-7053	$30,580	$1,682	-	601	-	$1,911	16.0	1.3	LOCAL
7004	BOILER TIE-7007	$30,580	$1,682	-	601	-	$1,911	16.0	1.3	LOCAL
60	WALL INSULATION	$15,813	$870	$18,564	313	-	$995	15.9	1.3	ECIP
7086	INSULATION	$3,220	$177	$3,780	60	6	$216	14.9	1.3	ECIP
315	REPAIR CONTROLS	$4,591	$253	$5,105	141	-	$448	10.2	1.3	QRIP
7224	BOILER TIE-7227	$34,650	$1,906	-	666	-	$2,118	16.4	1.2	LOCAL
7230	BOILER TIE-7233	$34,650	$1,906	-	666	-	$2,118	16.4	1.2	LOCAL
7264	STORM WINDOWS	$903	$50	$1,060	13	4	$60	15.1	1.2	ECIP
7264	RED. GLASS	$2,860	$157	$3,358	44	15	$203	14.1	1.2	ECIP
187	WALL INSULATION	$29,360	$1,615	$34,469	504	20	$1,687	17.4	1.1	ECIP
92	CHNG. TO 2-PIPE	$34,300	$1,887	-	535	-	$1,701	20.2	1.0	LOCAL
64	WALL INSULATION	$15,450	$850	$18,138	244	-	$776	19.9	1.0	ECIP
7866	EMCS	$20,393	$1,122	-	408	86	$1,661	12.3	1.0	LOCAL

TOTALS:

CONSTRUCTION COST (JANUARY 1986):	$1,213,762
SIOH:	$66,757
ECIP PROGRAMMED YEAR COST (FY 1991):	$817,000
QRIP/PECIP PROGRAMMED YEAR COST (FY 1989):	$87,000
TOTAL ANNUAL DOLLAR SAVINGS:	$236,288
SIMPLE PAYBACK (YEARS):	5.1
ANNUAL ENERGY SAVINGS - NATURAL GAS (MTU):	40944.00
ANNUAL ENERGY SAVINGS - ELECTRICITY (MBTU @ 11,600 BTU/KWH):	9661.00
ANNUAL ENERGY SAVINGS - FUEL OIL (MBTU):	2067.00

ENERGY SAVINGS OPPORTUNITY SURVEY
ORT RILEY, KANSAS
DACA 41-85-0096

THE SCHEMMER ASSOCIATES INC.
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PROJECT SUMMARY: INSULATION AND WINDOW IMPROVEMENTS (ECIP)
NOTE: SAVINGS ARE 100% ENERGY SAVINGS

BUILDING NUMBER	PROJECT DESCRIPTION	CONST. COST	ANNUAL ENERGY SAVINGS	ENERGY DISCOUNTED SAVINGS	SIR	SIMPLE PAYBACK	ANNUAL MBTU SAVINGS
462	INSUL. PANELS-WINDOWS	$1,456	$696	$14,089	9.7	2.1	219
463	INSUL. PANELS-WINDOWS	$1,456	$696	$14,089	9.7	2.1	219
483	INSUL. PANELS-WINDOWS	$1,456	$696	$14,089	9.7	2.1	219
64	ROOF/CEIL. INSULATION	$5,428	$2,140	$43,295	8.0	2.5	673
32	REDUCE GLASS AREA-INSUL.	$576	$172	$3,474	6.0	3.3	54
82	ROOF/CEIL. INSULATION	$13,464	$3,581	$72,437	5.4	3.8	1126
60	ROOF/CEIL. INSULATION	$2,306	$553	$11,194	4.9	4.2	174
83	ROOF/CEIL. INSULATION	$7,175	$1,717	$34,739	4.8	4.2	540
32	WALL INSULATION	$10,438	$2,077	$42,008	4.0	5.0	653
60	ADD STORM WINDOWS	$1,631	$283	$5,725	3.5	5.8	89
27	ROOF/CEIL. INSULATION	$12,717	$2,086	$42,201	3.3	6.1	656
187	ADD STORM WINDOWS	$890	$140	$2,831	3.2	6.4	44
7802	INSUL. PANELS-WINDOWS	$1,002	$156	$3,152	3.1	6.4	49
7808	INSUL. PANELS-WINDOWS	$1,002	$156	$3,152	3.1	6.4	49
7852	INSUL. PANELS-WINDOWS	$1,002	$156	$3,152	3.1	6.4	49
7858	INSUL. PANELS-WINDOWS	$1,002	$156	$3,152	3.1	6.4	49
27	INSUL. PANELS-WINDOWS	$2,240	$340	$6,883	3.1	6.6	107
7602	INSUL. PANELS-WINDOWS	$1,637	$245	$4,954	3.0	6.7	77
7608	INSUL. PANELS-WINDOWS	$1,637	$245	$4,954	3.0	6.7	77
7652	INSUL. PANELS-WINDOWS	$1,637	$245	$4,954	3.0	6.7	77
7658	INSUL. PANELS-WINDOWS	$1,637	$245	$4,954	3.0	6.7	77
82	ADD STORM WINDOWS	$335	$48	$965	2.9	7.0	15
7245	ADD STORM WINDOWS	$422	$64	$1,173	2.8	6.6	19
7245	REDUCE GLASS AREA-WALL	$17,723	$2,797	$49,587	2.8	6.3	818
7606	REDUCE GLASS AREA-WALL	$17,723	$2,797	$49,587	2.8	6.3	818
7656	REDUCE GLASS AREA-WALL	$17,723	$2,797	$49,587	2.8	6.3	818
7804	REDUCE GLASS AREA-WALL	$17,723	$2,797	$49,587	2.8	6.3	818
7806	REDUCE GLASS AREA-WALL	$17,723	$2,797	$49,587	2.8	6.3	818
7854	REDUCE GLASS AREA-WALL	$17,723	$2,797	$49,587	2.8	6.3	818
7856	REDUCE GLASS AREA-WALL	$17,723	$2,797	$49,587	2.8	6.3	818
83	ADD STORM WINDOWS	$2,924	$375	$7,591	2.6	7.8	118
27	ADD STORM WINDOWS	$4,360	$502	$10,164	2.3	8.7	158
315	ADD STORM WINDOWS	$6,243	$782	$14,126	2.3	8.0	231
462	ROOF/CEIL. INSULATION	$5,732	$611	$12,352	2.2	9.4	192
32	ROOF/CEIL. INSULATION	$34,463	$3,533	$71,472	2.1	9.8	1111
801	ROOF/CEIL. INSULATION	$11,934	$1,166	$23,588	2.0	10.2	386
7404	ADD STORM WINDOWS	$33,982	$3,223	$62,076	1.8	10.5	986
7424	ADD STORM WINDOWS	$33,982	$3,223	$62,076	1.8	10.5	986
40	ADD STORM WINDOWS	$3,543	$280	$5,661	1.6	12.7	88
82	WALL INSULATION	$27,628	$1,895	$38,342	1.4	14.6	596
82	INSUL. PANELS-WINDOWS	$314	$22	$450	1.4	14.3	7
7865	ROOF/CEIL. INSULATION	$3,031	$216	$4,148	1.4	14.0	66

ENERGY SAVINGS OPPORTUNITY SURVEY
FORT RILEY, KANSAS
DACA 41-85-0096

THE SCHEMMER ASSOCIATES INC.
ARCHITECTS · ENGINEERS · PLANNERS

PROJECT SUMMARY: INSULATION AND WINDOW IMPROVEMENTS (ECIP)

BUILDING NUMBER	PROJECT DESCRIPTION	CONST. COST	ANNUAL ENERGY SAVINGS	ENERGY DISCOUNTED SAVINGS	SIR	SIMPLE PAYBACK	ANNUAL MBTU SAVINGS
5315	ADD STORM WINDOWS	$5,718	$451	$8,115	1.4	12.7	133
7086	ROOF/CEIL. INSULATION	$3,220	$216	$4,148	1.3	14.9	66
60	WALL INSULATION	$15,813	$995	$20,136	1.3	15.9	313
7264	ADD STORM WINDOWS	$903	$60	$1,048	1.2	15.1	18
7264	REDUCE GLASS AREA-WALL	$2,860	$203	$3,551	1.2	14.1	59
187	WALL INSULATION	$29,360	$1,687	$33,383	1.1	17.4	524
64	WALL INSULATION	$15,450	$776	$15,697	1.0	19.9	244

PROJECT TOTALS:

CONSTRUCTION COST:	$438,067
ANNUAL ENERGY SAVINGS:	$56,688
OVERALL SIR:	2.5
SIMPLE PAYBACK:	7.7
DISCOUNTED ENERGY SAVINGS:	$1,086,849
ANNUAL MBTU SAVINGS:	17319

ENERGY SAVINGS OPPORTUNITY SURVEY
FORT RILEY, KANSAS
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THE SCHEMMER ASSOCIATES INC
ARCHITECTS · ENGINEERS · PLANNERS

PROJECT SUMMARY: REPLACE INCANDESCENT FIXTURES (ECIP)

BUILDING NUMBER	CONSTR. COST	ANNUAL MBTU SAVING	TOTAL ANNUAL SAVINGS	TEST SIR	SIR	SIMPLE PAYBACK	ENERGY DISCOUNTED SAVINGS	NON-ENERGY DISCOUNTED SAVINGS	TOTAL DISCOUNTED SAVINGS
7245	$6,003	228	$3,493	2.4	6.7	1.7	$10,946	$29,463	$40,409
7656	$6,601	248	$3,707	2.4	6.5	1.8	$11,907	$30,966	$42,873
7654	$6,601	248	$3,707	2.4	6.5	1.8	$11,907	$30,966	$42,873
7404	$4,860	183	$2,512	2.4	6.0	1.9	$8,786	$20,248	$29,034
7424	$4,860	183	$2,512	2.4	6.0	1.9	$8,786	$20,248	$29,034
7814	$1,945	74	$981	2.4	5.8	2.0	$3,553	$7,782	$11,335
7810	$1,945	74	$981	2.4	5.8	2.0	$3,553	$7,782	$11,335
7812	$1,945	74	$981	2.4	5.8	2.0	$3,553	$7,782	$11,335
7816	$1,945	74	$981	2.4	5.8	2.0	$3,553	$7,782	$11,335
7818	$1,945	74	$981	2.4	5.8	2.0	$3,553	$7,782	$11,335
7842	$1,945	74	$981	2.4	5.8	2.0	$3,553	$7,782	$11,335
7844	$1,945	74	$981	2.4	5.8	2.0	$3,553	$7,782	$11,335
7846	$1,945	74	$981	2.4	5.8	2.0	$3,553	$7,782	$11,335
7848	$1,945	74	$981	2.4	5.8	2.0	$3,553	$7,782	$11,335
[redacted]	$1,945	74	$981	2.4	5.8	2.0	$3,553	$7,782	$11,335
[redacted]	$3,971	167	$1,900	2.7	5.5	2.1	$8,018	$13,910	$21,928
7044	$3,807	85	$1,617	1.4	4.9	2.4	$4,081	$14,644	$18,725
7644	$3,025	80	$1,217	1.7	4.7	2.5	$3,841	$10,240	$14,081
7642	$3,025	80	$1,217	1.7	4.7	2.5	$3,841	$10,240	$14,081
7646	$3,025	80	$1,217	1.7	4.7	2.5	$3,841	$10,240	$14,081
7648	$3,025	80	$1,217	1.7	4.7	2.5	$3,841	$10,240	$14,081
7650	$3,025	80	$1,217	1.7	4.7	2.5	$3,841	$10,240	$14,081
7602	$9,855	336	$3,931	2.2	4.6	2.5	$16,132	$29,242	$45,374
7608	$9,855	336	$3,931	2.2	4.6	2.5	$16,132	$29,242	$45,374
7652	$9,855	336	$3,931	2.2	4.6	2.5	$16,132	$29,242	$45,374
7658	$9,855	336	$3,931	2.2	4.6	2.5	$16,132	$29,242	$45,374
315	$3,896	107	$1,444	1.8	4.3	2.7	$5,137	$11,545	$16,682
7606	$4,264	106	$1,528	1.6	4.1	2.8	$5,070	$12,594	$17,664
5315	$13,054	318	$4,233	1.6	3.7	3.1	$15,267	$33,645	$48,912
6940	$3,345	122	$1,088	2.3	3.7	3.1	$5,857	$6,664	$12,521
7013	$2,126	82	$685	2.5	3.7	3.1	$3,937	$3,938	$7,875
7004	$2,126	82	$685	2.5	3.7	3.1	$3,937	$3,938	$7,875
7007	$2,126	82	$685	2.5	3.7	3.1	$3,937	$3,938	$7,875
7010	$2,126	82	$685	2.5	3.7	3.1	$3,937	$3,938	$7,875
7050	$2,126	82	$685	2.5	3.7	3.1	$3,937	$3,938	$7,875
7053	$2,126	82	$685	2.5	3.7	3.1	$3,937	$3,938	$7,875
7804	$971	25	$287	1.6	3.4	3.4	$1,200	$2,109	$3,309
7806	$971	25	$287	1.6	3.4	3.4	$1,200	$2,109	$3,309
7854	$971	25	$287	1.6	3.4	3.4	$1,200	$2,109	$3,309
[redacted]	$971	25	$287	1.6	3.4	3.4	$1,200	$2,109	$3,309
[redacted]	$7,727	180	$2,095	1.5	3.1	3.7	$8,642	$15,541	$24,183

ENERGY SAVINGS OPPORTUNITY SURVEY
[redacted]RT RILEY, KANSAS
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THE SCHEMMER ASSOCIATES INC.
ARCHITECTS · ENGINEERS · PLANNERS

PROJECT SUMMARY: REPLACE INCANDESCENT FIXTURES

BUILDING NUMBER	CONSTR. COST	ANNUAL MBTU SAVING	TOTAL ANNUAL SAVINGS	TEST SIR	SIR	SIMPLE PAYBACK	ENERGY DISCOUNTED SAVINGS	NON-ENERGY DISCOUNTED SAVINGS	TOTAL DISCOUNTED SAVINGS
483	$2,360	84	$641	2.3	3.1	3.7	$4,033	$3,332	$7,365
27	$2,316	48	$555	1.3	2.8	4.2	$2,305	$4,101	$6,406
7264	$8,583	196	$1,943	1.5	2.6	4.4	$9,410	$12,987	$22,397
64	$5,390	129	$1,143	1.5	2.4	4.7	$6,193	$6,955	$13,148
7802	$2,877	93	$618	2.1	2.5	4.7	$4,465	$2,621	$7,086
7808	$2,877	93	$618	2.1	2.5	4.7	$4,465	$2,621	$7,086
7852	$2,877	93	$618	2.1	2.5	4.7	$4,465	$2,621	$7,086
7858	$2,877	93	$618	2.1	2.5	4.7	$4,465	$2,621	$7,086
82	$1,513	36	$286	1.5	2.2	5.3	$1,728	$1,561	$3,289
7632	$10,717	213	$1,468	1.3	1.6	7.3	$10,226	$6,606	$16,832
7832	$10,717	213	$1,468	1.3	1.6	7.3	$10,226	$6,606	$16,832
463	$773	12	$104	1.0	1.5	7.4	$576	$617	$1,193
[redacted]024	$12,665	254	$1,666	1.3	1.5	7.6	$12,195	$6,897	$19,092

PROJECT TOTALS:

ENERGY SAVINGS, (3,413 BTU/KWH)	2003
ENERGY SAVINGS, MBTU (11,600 BTU/KWH)	6808
CONSTRUCTION COST:	$226,166
ANNUAL ENERGY SAVINGS:	$28,792
ANNUAL NON-ENERGY SAVINGS:	$49,667
ANNUAL TOTAL SAVINGS:	$78,459
ECIP TEST SIR:	1.9
OVERALL SIR:	4.0
SIMPLE PAYBACK:	2.9
DISCOUNTED ENERGY SAVINGS:	$326,841
DISCOUNTED NON-ENERGY SAVINGS:	$578,632
DISCOUNTED TOTAL SAVINGS:	$905,473

ENERGY SAVINGS OPPORTUNITY SURVEY
FORT RILEY, KANSAS
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THE SCHEMMER ASSOCIATES INC.
ARCHITECTS · ENGINEERS · PLANNERS

PROJECT SUMMARY:
QRIP/PECIP PACKAGE 1
CONTROL REPAIR AND FUNCTION CHANGES

BUILDING NUMBER	PROJECT DESCRIPTION	CONST. COST	ANNUAL ENERGY SAVINGS	ENERGY DISCOUNTED SAVINGS	SIR	SIMPLE PAYBACK	ANNUAL MBTU SAVINGS
8069	HUMIDISTAT CONTROL	$3,000	$12,216	$150,012	50	0.2	2067
7865	BLOCK OUTSIDE AIR	$340	$410	$5,404	16.0	0.8	129
7024	CHANGE CONTROLS	$2,550	$2,919	$38,472	15.1	0.9	918
7602	MISC. ADJUSTMENTS	$140	$83	$759	5.4	1.7	20
7608	MISC. ADJUSTMENTS	$140	$83	$759	5.4	1.7	20
7652	MISC. ADJUSTMENTS	$140	$83	$759	5.4	1.7	20
7658	MISC. ADJUSTMENTS	$140	$83	$759	5.4	1.7	20
7264	CONTROL OUTSIDE AIR	$7,270	$2,884	$38,011	5.2	2.5	907
863	ELIMINATE O.A.	$1,065	$350	$4,597	4.3	3.0	110
7086	BLOCK OUTSIDE AIR	$370	$67	$883	2.4	5.5	21
32	ADD NIGHT SETBACK	$6,280	$992	$13,074	2.1	6.3	312
92	ADD NIGHT SETBACK	$6,280	$954	$12,478	2.0	6.6	300
7044	REVISE CONTROLS	$15,990	$2,321	$30,591	1.9	6.9	730
315	REPAIR CONTROLS	$4,600	$448	$5,905	1.3	10.3	141

PROJECT TOTALS

PROJECT SIR:	6.3
SIMPLE PAYBACK:	2.0
CONSTRUCTION COST:	$48,305
ENERGY DISCOUNTED SAVINGS:	$302,463
ANNUAL ENERGY SAVINGS:	$23,893
ANNUAL MBTU SAVINGS:	5715

ENERGY SAVINGS OPPORTUNITY SURVEY
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THE SCHEMMER ASSOCIATES INC.
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PROJECT SUMMARY:
QRIP/PECIP PACKAGE 2
SEPARATE DOMESTIC WATER HEATING

BUILDING NUMBER	PROJECT DESCRIPTION	CONST. COST	ANNUAL ENERGY SAVINGS	ENERGY DISCOUNTED SAVINGS	SIR	SIMPLE PAYBACK	ANNUAL MBTU SAVINGS
440 441 442	DOMESTIC WATER HEATING	$29,660	$9,527	$125,566	4.2	3.1	2996

PROJECT TOTALS

PROJECT SIR:	4.2
SIMPLE PAYBACK:	3.1
CONSTRUCTION COST:	$29,660
ENERGY DISCOUNTED SAVINGS:	$125,566
ANNUAL ENERGY SAVINGS:	$9,527
ANNUAL MBTU SAVINGS:	2996

ENERGY SAVINGS OPPORTUNITY SURVEY
FORT RILEY, KANSAS
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THE SCHEMMER ASSOCIATES INC.
ARCHITECTS · ENGINEERS · PLANNERS

PROJECT SUMMARY: RECOMMENDED ENERGY CONSERVATION OPPORTUNITIES
ANALYSIS DATE: JANUARY 1986
LOCAL FUNDING PROJECTS

BLDG. NO.	PROJECT DESCRIPTION	CONST. COST	SIOH	ANN'L ENERGY SAVINGS-MBTU GAS	ELEC	TOTAL ANNUAL SAVINGS	SMPL PYBK	SIR
32	INSUL. DUCTS	$540	$30	222	–	$706	0.8	17.0
187	WATER HEATER	$40	$2	8	–	$25	1.6	8.1
7245	EMCS ECON.	$3,510	$193	–	421	$1,781	2.0	4.6
7245	EMCS START STOP	$15,400	$847	1449	–	$4,608	3.3	3.9
187	MISSING STORMS	$1,467	$81	69	9	$257	5.7	3.3
441	LIGHTING	$5,250	$289	–	66	$1,438	3.7	3.2
7856	EMCS SETBACK	$20,400	$1,122	1449	–	$4,608	4.4	3.0
7854	EMCS SETBACK	$20,400	$1,122	1449	–	$4,608	4.4	3.0
7806	EMCS SETBACK	$20,400	$1,122	1449	–	$4,608	4.4	3.0
7804	EMCS SETBACK	$20,400	$1,122	1449	–	$4,608	4.4	3.0
462	EMCS (3 BLDGS)	$23,572	$1,296	1500	–	$4,770	4.9	2.7
7245	ADD METAL DOORS	$773	$43	28	–	$89	8.7	2.3
187	REPLACE BOILER	$25,250	$1,389	867	–	$2,757	9.2	2.2
187	INSUL. DOOR	$27	$1	1	–	$3	9.0	2.0
27	REPL. DOORS	$230	$13	7	–	$22	10.5	1.9
7264	ADD SOLAR FILM	$1,255	$69	31	7	$128	9.8	1.9
7832	EMCS	$14,670	$807	670	–	$2,131	6.9	1.9
7632	EMCS	$14,670	$807	670	–	$2,131	6.9	1.9
7024	EMCS	$14,670	$807	670	–	$2,131	6.9	1.9
7285	INSUL & CEILING	$1,856	$102	71	7	$166	11.2	1.7
7013	BOILER TIE-7010	$30,580	$1,682	601	–	$1,911	16.0	1.3
7050	BOILER TIE-7053	$30,580	$1,682	601	–	$1,911	16.0	1.3
7004	BOILER TIE-7007	$30,580	$1,682	601	–	$1,911	16.0	1.3
7224	BOILER TIE-7227	$34,650	$1,906	666	–	$2,118	16.4	1.2
7230	BOILER TIE-7233	$34,650	$1,906	666	–	$2,118	16.4	1.2
92	CHNG. TO 2-PIPE	$34,300	$1,887	535	–	$1,701	20.2	1.0
7866	EMCS	$20,393	$1,122	408	86	$1,661	12.3	1.0

TOTALS:

CONSTRUCTION COST (JANUARY 1986):	$420,513
SIOH:	$23,128
TOTAL ANNUAL DOLLAR SAVINGS:	$54,906
SIMPLE PAYBACK (YEARS):	7.7
ANNUAL ENERGY SAVINGS - NATURAL GAS (MTU):	16137.00
ANNUAL ENERGY SAVINGS - ELECTRICITY (MBTU @ 11,600 BTU/KWH):	596.00

WAGE RATES

	Rate	Benefits	Supervision	TOTAL
Asbestos Worker	$17.29	$ 4.35	$ 3.25	$24.89
Brick Layer	$14.89	$ 1.27	$ 2.42	$18.58
Carpenter	$11.93	$ 1.80	$ 2.06	$15.79
Cement Mason	$12.60	$ 1.05	$ 2.05	$15.70
Electrician	$15.55	$ 2.60	$ 2.72	$20.87
Laborer	$ 8.90	$ 2.05	$ 1.64	$12.59
Painter	$14.44	--	$ 2.17	$16.61
Plumber	$18.88	$ 1.98	$ 3.00	$22.98
Sheet Metal Worker	$14.68	$ 4.09	$ 2.82	$21.59

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